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ORIGINAL ARTICLE

How Implicit Motives and Everyday Self-Regulatory Abilities Shape Cardiovascular Risk in Youth

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Abstract
Background and Purpose Tested hypotheses from social action theory that (a) implicit and explicit measures of agonistic (social control) motives and transcendence (self-control) motives differentially predict cardiovascular risk; and (b) implicit motives interact with everyday self-regulation behaviors to magnify risk.
Methods Implicit/explicit agonistic/transcendence motives were assessed in a multi-ethnic sample of 64 high school students with the Social Competence Interview (SCI). Everyday self-regulation was assessed with teacher ratings of internalizing, externalizing, and self-control behaviors. Ambulatory blood pressure and daily activities were measured over 48 h.
Results Study hypotheses were supported: implicit goals predicted blood pressure levels but explicit self-reported coping goals did not; self-regulation indices did not predict blood pressure directly but interacted with implicit agonistic/transcendence motives to identify individuals at greatest risk (all $p \leq 0.05$).
Conclusions Assessment of implicit motives by SCI, and everyday self-regulation by teachers may improve identification of youth at risk for cardiovascular disease.

Keywords Emotion regulation · Stress · Cardiovascular disease · Adolescent health · Implicit motives

Biological models of stress-related illness describe pathologies that develop gradually when one's exposure to stressful conditions is recurring or prolonged [1]. Such models call for psychosocial accounts explaining how people become chronically embroiled in stress-inducing circumstances. Social action theory proposes that exposure to health-damaging stress is greatly affected by personal goals and self-regulatory capabilities. Goals shape the type, frequency, and character of social encounters, and self-regulatory skills modulate the magnitude, duration, and patterning of physiologic responses that encounters evoke. Individuals who often seek to influence or control others, for example, can easily provoke hostile exchanges and coercive struggles that generate sustained elevations of blood pressure [2] that are detrimental to cardiovascular health [3]. The ability to regulate an interaction and the emotions it evokes largely determines how long arousal persists [4]. Psychological mechanisms of motivation and self-regulation thus work together to influence levels of chronic stress: goals tend to increase stress exposure *directly*, by selecting and shaping social challenges, and self-regulatory capabilities tend to affect stress exposure more *indirectly*, by modulating physiologic responses [5].

In this analysis, goals represent the "why" of stress—motives explain why people often select, create, or fail to avoid stress-inducing interpersonal environments. Self-regulation represents the "how" of stress—self-regulatory strategies and skills explain how people cope, whether poorly or well, with the stressors that their goals create. Viewed in this way, motives and self-regulatory capabilities emerge as qualitatively different phenomena; the same motive or goal may demand very different action strategies, tactics, and skill sets, depending on the situation. A goal of successfully meeting an important deadline for a professional project, for example, can require an ability to be forcefully assertive with some colleagues as well as an ability to deftly avoid or gently placate others. And skill in regulating unwanted arousal may serve many different goals.

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The analysis of social–motivational processes that create stress exposure is not widely evident in contemporary stress research, which has focused extensively on stress "reactivity," or how people react to stressors when exposed. On the antecedent side, psychological constructs that might generate the stressors often are represented as personality traits such as hostility, anger-proneness, negative affectivity, neuroticism, or optimism—that is, as broad behavioral trends or averages as opposed to causal mechanisms. Causal analysis has been pursued by social-cognitive theorists who argue that psychological processes may threaten health by fostering problematic interpersonal transactions [6, 7]. Although theorists in this tradition have included motivational constructs in their thinking (e.g., [8–10]), transactional research in the health domain has focused almost exclusively on beliefs, attitudes, expectancies, appraisals, behaviors, and emotions—not goals. Appraisals of control or self-efficacy, hostile beliefs, and emotional responses play a crucial role in shaping perceptions of threats and coping options. But they do not select, organize, and impel behaviors that raise or lower stress exposure. Goals do [11]. Even if one accepts the view that certain emotions may incorporate rudimentary goals—perhaps as response-specific "action tendencies" [12]—there are cogent reasons to regard emotions and motives as qualitatively different [e.g., 13, 14]. This issue aside, it is difficult to specify causal pathways by which goals influence health unless one defines and measures goals independently of affect, reactivity, and related constructs.

A second obstacle to social–motivational analysis arises from the fact that the personality constructs that have been linked to major diseases—for example, Type A behavior, hostility, and depression—represent heterogeneous collections of diverse emotions, beliefs, behaviors, and attitudes that often are weakly intercorrelated and overlap with other constructs [15]. These conceptual frameworks do not afford well-specified and testable models of processes by which motives activate and bias stress-inducing appraisals, beliefs, attitudes, or affects, or indicate how self-regulatory capabilities let people modulate physiologic responses while pursuing valued aims [5]. Thus the field's dominant psychosocial constructs do not suggest how goals and capabilities combine and interact to foster chronic stress.

Finally, there are reasons to suspect that the self-report instruments that often are used to assess motivation and self-regulation may not be adequately sensitive to the goals and regulatory skill deficits that foster recurring stress. Social action theory proposes that many of the goals and self-regulatory strategies that foster chronic stress exposure are *implicit*, that is, they are experienced so frequently in stressful situations that they become embedded in habitual action sequences that are executed automatically and unthinkingly [16, 17]. Thus, implicit goals often are not a focus of direct attention or self-monitoring, and therefore can be difficult for people to self-observe and reliably report on questionnaires. This suggests the importance of using "situationally grounded" or "bottom-up" behavioral methods that measure an individual's ability to generate goals and execute self-regulatory maneuvers in situations that frequently cause personal stress [18].

An example of this approach is the Social Competence Interview (SCI; 19), an emotionally evocative narrative assessment task designed to yield situationally grounded indices of implicit and explicit strivings that foster recurring stress. The interview procedure involves, first, reliving a problem situation that causes recurring distress; then pretending that the problem just described is a movie about someone else; and finally, inventing a desirable ending and narrative plot line for the film. Implicit motives in the stressful situation are inferred from the film ending and narrative (see below). Social action theory asserts that, as implicit goals regularly guide our recurring interactions with others, chronic interpersonal stress and indices of related cardiovascular disease risk should correlate more strongly with implicit motives, derived from the film narrative, than with explicit social motives reported by the participant. Implicit motives assessed by the SCI interact with self-regulatory capabilities to increase or lower stress exposure.

Motivation, Self-Regulation, and Cardiovascular Risk in Youth

The potential value of this social–motivational analysis is supported by recent community-based studies of high-risk Black and White urban youth. Two large research projects involving over 500 adolescents in different cities assessed youths' implicit motives in stressful situations and measured their levels of cardiovascular risk indexed by levels of ambulatory blood pressure during daily activities [5, 19]. In normotensive youth, elevated ambulatory blood pressure during daily activities is associated with a significantly greater likelihood of developing hypertension in early adulthood [20, 21]. Findings in both community studies revealed three motivational profiles with differing implications for risk. One profile, known as "agonistic striving," involves recurring stress arising from efforts to influence, manage, or control other people's actions. A second motivational profile, known as "transcendence striving," involves recurring stress arising from efforts to control, change, or improve the self. A third profile, "dissipated striving," involves recurring stress arising from failures to assert control, whether of self or others.

To illustrate these patterns, consider three individuals who experience "relationship stress." All three report that the instigating event was a conflict with a friend. All attribute the conflict to a betrayal of trust, and expect that

rebuilding trust will be very difficult. All report feeling sad and angry, and all cope by confronting the friend, venting their emotions, talking to a trusted confidant, and retreating to their bedroom to listen to soulful songs. Yet despite their highly similar attributions, appraisals, emotions, and coping behaviors, these individuals may generate very different implicit goals. Person A hopes to get the friend to change her mind (agonistic striving). Person B hopes to learn to prevent or better manage similar relationship difficulties in the future (transcendence striving). Person C, lacking any distinct aim, passively wishes that the problem would just go away (dissipated striving). We propose that, despite these individuals' striking similarities with respect to standard cognitive, affective, and behavioral indices of stress and coping, their goal differences alone may lead them to engage their social worlds in very different ways. These differences can have important, differing consequences for chronic stress exposure and illness outcomes.

This example suggests that agonistic striving is *not* equivalent to seemingly similar constructs such as hostility, dominance, trait anger, or antagonistic personality. Person A's agonistic struggle to change the friend's mind may be expressed in bitter accusations, angry looks, and sarcastic remarks, yet also in inviting glances, gentle humor, and submissive pleading. Person A's behaviors, affects, and attitudes toward the friend can be highly diverse, yet all serve the same goal, which creates the agonistic pattern. We propose that a continuing agonistic struggle to change another person's thoughts, feelings, or actions—"by any means necessary" (friendly, hostile, dominant, submissive)—can become a unique source of continuing stress.

In both studies mentioned above, each profile—agonistic, transcendent, dissipated—characterized from 26% to 39% of adolescents in the sample; the profiles occurred with similar frequencies across differences of geographic region, race, and gender. Youths with the agonistic profile exhibited significantly higher levels of ambulatory blood pressure than did individuals with the other profiles. Moreover, the association between the agonistic profile and elevated blood pressure was strongest in persons who also exhibited difficulty regulating angry emotions in the laboratory during an experimental attention-control task [5]. Findings from the two studies support predictions from social action theory by disclosing that agonistic goals predict higher ambulatory pressure, and that this effect is amplified (moderated) by an inability to regulate angry emotions through attention-shifting [22].

This research also provided evidence that implicit motives and the ability to regulate negative emotions in daily life are independent phenomena. Participants' ratings of negative affect (anger, sadness), recorded on electronic diaries at 30-min intervals during waking hours over the course of 2 days, were unrelated to their levels of agonistic or transcendence motivation [5].

These findings support the importance of social motives as predictors of risk, and confirm the value of distinguishing between motivational and self-regulatory mechanisms of chronic stress exposure. The discovery that goals affect health directly, as well as in combination with self-regulation skills, opens new horizons for stress research. But this work leaves important questions unanswered. The research reported thus far does not disclose if implicit goals offer unique information about stress exposure and cardiovascular risk that could not be obtained from explicit self-report. Does the act of constructing a film narrative disclose underlying motives that differ from motives one reports when asked about one's coping goals? Are these film-derived motives better predictors of cardiovascular risk? Nor does prior research reveal if self-regulation capabilities assessed by an attention-control task in the laboratory tell us how emotion-regulation operates in the real world to raise or lower risk. How, and to what extent, do the characteristic emotional styles, self-regulatory skills, and self-control tactics that people display from day to day in natural social settings moderate the relationship between their agonistic or transcendent motives and their exposures to health-damaging stress? Answers to these important questions may suggest new ways to identify persons who are especially vulnerable to stress-related illness and to help them lower their levels of risk.

Agonistic Striving and Everyday Self-Regulation

We examined the relationships between implicit agonistic motives, naturalistic (and ecologically valid) self-regulation in a real-world setting, and blood pressure during daily activities in a subgroup of high school students who had participated in the laboratory attention-control protocol cited above. Teachers who taught the participants rated the social and emotional self-regulation capabilities and difficulties that the students typically displayed in the classroom. These rating data were analyzed to determine if, like the laboratory attention-shifting task, more naturalistic observational indices of everyday self-regulation, displayed over many weeks in a school setting, moderated the association between agonistic motives and elevated ambulatory blood pressure during daily activities.

"Noticeable" self-regulatory capabilities and emotional difficulties that young people display in daily life were measured by obtaining teachers' assessments of participants' internalizing, externalizing, and self-control behaviors in the classroom. Individuals with high levels of internalizing often exhibit emotions such as anxiety and sadness, whereas those with high levels of externalizing often exhibit angry emotions and aggressive behavior [23]. Persons with high levels of self-control display a high

degree of social–emotional competence, or the ability to regulate their behavior in ways that let them engage positively with others. Each of these indices of publicly observable emotion and self-regulation in natural settings has been associated with social–emotional adjustment in youth and young adulthood [23].

The present study evaluated two major hypotheses derived from social action theory. First, we tested the assumption that distinguishing between implicit and explicit indices of motivation is important because the two indices yield different kinds of information. We examined the associations among ratings of agonistic goals and transcendence goals made by: (a) SCI interviewers; (b) independent observers who listened to SCI audio recordings; and (c) the participants themselves. We then analyzed the pattern of correlations to test the hypothesis that self-reported *explicit* agonistic and transcendence motives correlate only modestly with interviewer and observer ratings of *implicit* agonistic and transcendence motives, and interviewer and observer ratings of implicit motives correlate highly with each other. This prediction, if supported, would suggest that implicit agonistic goals that have been shown to predict increased stress exposure and higher blood pressure may not be reliably assessed via self-report, but may instead require *indirect* methods such as the SCI film narrative exercise.

Second, by modulating arousal during interpersonal encounters, self-regulatory capabilities are presumed to *moderate* the relationship between agonistic motives and blood pressure. We tested this hypothesis by seeking to determine if a statistically significant interaction between agonistic motives and teacher indices of self-regulation emerges when blood pressure levels during social interactions are regressed on both of these predictors and their interaction. The detection of a significant interaction effect would imply that agonistic control motives tend to increase risk, and that this tendency is magnified by difficulties with everyday self-regulation.

Method

This study was conducted with the last cohort of students entering a larger study, Project Heart 5 (N=167) that investigated agonistic stress and elevated ambulatory blood pressure in low-income youth [5]. All were enrolled in the ninth grade in a large public high school in Syracuse, New York. The sample had a median family income of $25,000; half of the parents had completed high school. The present sample (N=64) consisted of 89% of the 72 students in the last Project Heart 5 cohort (enrolled in 2007). The present 64 were participants for whom it was possible to obtain teacher ratings of everyday self-regulation in the classroom. Two previous studies with the full Project Heart 5 sample have investigated the effects of agonistic motives and anger in elevating blood pressure, and the role of agonistic striving in mediating the association between environmental stress and hypertension risk [24]. The present study investigates a very different set of questions with new data on participants' explicit motives and observational measures of everyday self-regulation.

Participants

Students in the last cohort of Project Heart 5 for whom parental consent had been obtained were invited to assent to take part in a sub-study of stress-related classroom behaviors observed by teachers. Teachers then were invited to complete the rating forms. All procedures were approved by the Institutional Review Board of Syracuse University. Characteristics of the present subsample are shown in Table 1 (for further information about sample recruitment and participation, see Ewart et al. [5]). Analyses comparing the present sample to the other 103 participants in Project Heart 5 (n=167) from which this subgroup was drawn revealed no statistically significant differences with respect to any of the Table 1 variables.

Procedure

Assessments were conducted at school in a quiet room that served as the Project Heart laboratory. At the first session, participants' height, weight, and blood pressure were measured and, they completed the SCI assessment of implicit and explicit motives. The body mass index was calculated as the ratio of weight to height squared (in kilograms per square meter).

About 2.5 months later, participants again visited the lab to be fitted with an ambulatory blood pressure monitor and

Table 1 Characteristics of the sample (N=64)

Variable	Mean±SD or %
Age at study entry	14.3±0.5 years
Female	52%
Ethnic background (Black/White/Other)	48%/36%/16%
Body mass index	25.5±6.2 kg/m^2
Resting blood pressure (mmHg)	
Systolic	120.3±12.0
Diastolic	64.9±7.0
Ambulatory blood pressure (mmHg) when interacting	
Systolic	128.7±12.4
Diastolic	73.7±8.5
Mean arterial pressure	90.0±9.0

taught to use an electronic diary for ecological momentary assessment. The monitor (Oscar, SunTech Medical, Morrisville, NC) was programmed to record blood pressure at 30-min intervals during the day and at 60-min intervals during nighttime sleep. For two days and two nights (48 h), participants recorded their activities and emotions on the electronic diary using custom software (Palm Pilot zire22, Sunnyvale, CA) which prompted them to answer a series of questions each time blood pressure was recorded. The entries included their location, position, and activity level, and whether they had interacted with someone in person, by phone, or online in the past 5 min. Participants visited the lab at school the next morning to have the Oscar reattached after their morning shower. They returned the monitor to the lab at the end of the 48-hr recording period. The ambulatory readings later were edited to identify erroneous values (approximately 1.4% of the readings were judged to be errors), and to determine if the time interval between the blood pressure reading and the participant's subsequent diary entry did not exceed the 5-min criterion (69% of readings satisfied this criterion). The reading-to-diary entry interval was not significantly correlated with the agonistic or transcendent goal scores, nor with the teacher ratings. Activities recorded in the diary were subdivided into three categories: (a) Social interaction; (b) Awake (7 a.m. to 10 p.m.); and (c) Sleep (12 a.m. to 5 a.m.). "Social Interactions" were encounters that took place ≤10 min before a reading and were reported within 5 min after the reading. Further details of these procedures have been published elsewhere [5].

Toward the end of the academic year in which participants completed these assessments, teachers who had taught the participants while they were taking part in the study were invited to rate indices of participants' everyday self-regulation in the classroom. Teachers who agreed to participate were given questionnaire packets containing scales measuring internalizing, externalizing, and self-control behaviors. As a token of appreciation, the teacher received $4.00 for each questionnaire packet returned. Twenty-one teachers rated the 64 participants.

Social Competence Interview (SCI)

Implicit and explicit motives were assessed with the 10-min SCI, described in detail elsewhere [25, 26]. The interviewer helps the participant describe and re-experience a problem situation that causes recurring personal distress; then, the participant pretends that he or she is a film director making a film about a person like the participant who experiences a similar problem. The goal is to invent a desirable but realistic ending and story line for the film, and then to indicate how the goals and strategies in the film narrative might apply to one's own personal problem. The film ending and strategies indicate the participant's implicit goal for resolving recurring challenges that often cause stress; the ability to describe the situation vividly, and to express the emotions aroused, indexes the likelihood that the goal arouses stress in everyday life. The interviewers—White female graduate students in clinical psychology—were trained and supervised by Craig Ewart, following procedures described elsewhere [27]. Interviewers were unaware of the study hypotheses.

Measures

Control Motives

Agonistic goals and transcendence goals in the SCI narratives were assessed with rating scales completed by interviewers, observers, and participants. The present use of *goal scales* deserves comment. The agonistic striving and transcendence striving constructs usually are represented as group profiles, or qualitatively distinct categories, defined by an individual's levels of agonistic striving, transcendence striving, and degree of emotional expressiveness during the SCI [5, 19, 24]; profile-related differences in health outcomes then are evaluated by comparing profile group means. Our present hypotheses, however, required us to use the separate agonistic and transcendence goal scale scores, instead of the profiles. Were we to use the profiles, we would not be able to compare participants' self-rated agonistic and transcendence goals with the agonistic and transcendence goal ratings made by interviewers and observers (group profiles cannot be constructed from the self-rating data because participants do not rate their degree of observable emotion during the SCI).

SCI Goal Scales

Agonistic goals and transcendence goals were measured with a reliable and valid coding system [28]. Goal scales were completed by (a) interviewers, immediately after the SCI; (b) independent observers, using interview audio recordings; and (c) participants, immediately post-SCI. Instructions for participants asked them to indicate what they had "wanted to happen" in the stressful situation they described during the SCI. Interviewer and participant ratings were made on seven-point Likert-type scales (1 = *Not at all*, 7 = *Very much*); observers used five-point scales with identical anchor points (earlier research had shown that, when rating goals from audio recordings, a five-point rating format yields better scale distributions than does a seven-point rating format). Previous research has shown these scales to have good internal reliability (e.g., Cronbach's alpha≥0.78) and adequate temporal stability (e.g., $r \geq 0.50$) over a 3-month period [5, 25]. Agonistic items included goals such as trying to change or control other people's behavior to get

them to be friendlier, more compliant, less critical, more sympathetic, less demanding, to "get them on my side," or to seek revenge. Transcendence items included goals such as trying to change or control one's own behavior to overcome a personal defect, to manage a difficult performance or achievement threat, live up to an important self-standard, or satisfy other people's expectations. Observers were five graduate students in clinical psychology trained and supervised by the first author; levels of inter-rater agreement exceeded r=0.80. Pairs of observers' ratings agreed within one unit on the five-point rating scales on 90% or more of comparisons.

Everyday Self-Regulation

Teachers rated participants' ability to regulate affect and social behavior in the real-world setting of the classroom with three scales from the Social Skills Questionnaire (Teacher Form, Grades 7–12) of the *Social Skills Rating System* [29]: Internalizing, Externalizing, and Self-Control. Scale items specified regulatory behaviors and deficits, rated on three-point Likert-type frequency scales ranging from "0 = Never", to "2 = Very Often." Internalizing items (n=6) included "shows anxiety about being in a group," "has low self-esteem," "is easily embarrassed," and "acts sad or depressed." Externalizing items (n=6) included "threatens or bullies others," "fights," "has temper tantrums," "talks back to adults when corrected," and "gets angry easily." Self-Control items (n=10) included "politely refuses unreasonable requests from others," "responds appropriately to teasing," "receives criticism well," "controls temper in conflict situations with peers," and "compromises in conflict situations by changing own ideas to reach agreement." Internal scale reliabilities (Cronbach's alpha) were: Internalizing, 0.86; Externalizing, 0.93; and Self-Control, 0.91.

Ambulatory Blood Pressure

Blood pressure levels during daily activities were used to index cardiovascular risk, which was the primary outcome variable. The prevailing blood pressure level, indexed by the mean of the blood pressure readings, represented the participant's aggregate level of risk [20] and served as the dependent variable in the tests of Hypothesis 2.

Analytic Approach

Hypothesis 1 concerned differences in the degree of association between implicit and explicit agonistic/transcendence goals rated by interviewers, observers, and participants. This hypothesis was evaluated by examining correlations among the respective goal indices. Hypothesis 2 states that implicit goals affect blood pressure directly, whereas self-regulatory capabilities influence blood pressure indirectly, by interacting with agonistic motives. This hypothesis was tested with general linear models with Type III sums of squares solutions (SAS Institute, Cary, NC) that regressed blood pressure level on implicit agonistic goals, self-regulation ratings (Internalizing, Externalizing, Self-Control), and the interaction of goals and self-regulation. In prior research with the full Project Heart 5 sample (N=167), analyses published in a previous report [5] tested predicted associations between motivational profiles (agonistic, transcendence) and blood pressure in models that included body mass, gender, race, and all interactions of these variables. Results of those analyses showed significant main effects for body mass, gender, and agonistic/transcendence motives, but not for race. Further, none of the interactions involving body mass, gender, or race were statistically significant. Prior to performing the analyses to test Hypothesis 2, we repeated those analyses in the present subsample (N=64), and obtained similar results. Therefore, in models testing the blood pressure effects predicted by Hypothesis 2, gender and body mass were included as covariates.

Finally, given that each teacher rated more than one student, we considered testing Hypothesis 2 with a multilevel design in order to model teacher-level variance. The intraclass correlations for each of the teacher-provided ratings (controlling for participant sex and BMI) indicated, however, that there was not a significant amount of teacher-level variance for any of the variables (intraclass r's ranged from 0.00–0.12, all p's>0.16). Therefore, there was no empirical rationale for adopting a multilevel analysis.

Results

Preliminary analyses examined factors that might confound the planned tests of study hypotheses. These included the frequency of social interactions, and the possibility that interaction frequency might covary with levels of the independent variables, as well as possible influences of gender or race. Examination of the electronic diary data revealed that 78% of blood pressure recordings during waking activities occurred during or less than 10 min after social interactions. The frequency of social interactions was not correlated with the measures of agonistic or transcendence goals, or with the frequencies of other activities (reclining, sitting, standing, walking/running), or the teacher indices of everyday self-regulation (Internalizing, Externalizing, Self-Control).

Between-group comparisons evaluating possible race and gender differences indicated that the ratings of agonistic goals and transcendence goals by interviewers, observers, and participants did not differ by participant gender or race;

values of p ranged from 0.07 to 0.96. Nor were significant gender or race differences detected in the teachers' ratings of Internalizing, Externalizing, and Self-Control; values of p ranged from 0.20 to 0.97.

Additional group comparisons evaluated the potential effects of gender, race, and body mass on blood pressure during social interactions; a statistically significant gender difference was detected for ambulatory systolic blood pressure, $t(62)=-2.00$, $p<0.05$, $d=0.49$; males had higher systolic pressure (M=131.8 mmHg, SD=13.4 mmHg) than females (M=125.8 mmHg, SD=10.6 mmHg). Body mass was significantly correlated with systolic pressure, $r=0.30$, $p<0.01$; and mean arterial pressure, $r=0.26$, $p<0.05$; but not with diastolic pressure. Blood pressure levels did not differ significantly by race.

Hypothesis 1: Measures of Implicit and Explicit Motives Yield Different Information

This hypothesis was evaluated by examining the intercorrelations among observer, interviewer, and participant ratings of agonistic goals and transcendence goals in the stressful situation recounted during the SCI. Results are shown in Table 2. Patterns of correlations revealed that participants' explicit (self-rated) agonistic goals were moderately correlated with implicit agonistic goal ratings made by observers and interviewers, but explicit ratings of transcendence goals did not correlate significantly with the Implicit ratings. The correlation coefficients in Table 2 indicated also that, whereas agonistic goals and transcendence goals were negatively correlated when rated by observers and by interviewers, these variables were strongly positively correlated when rated by the participants themselves. Comparisons with Implicit ratings by interviewers and observers suggested further that participants exhibited a marked "transcendence bias:" A two-way mixed ANOVA contrasting the ratings of agonistic goals and transcendence goals generated by interviewers and participants, respectively, showed that, unlike interviewers, participants rated their transcendence goals as significantly stronger than their agonistic goals; $t(62)=5.86$, $p<0.01$, $d=1.48$. The discrepancy between explicit transcendence and agonistic motives reported by participants was significantly larger than the discrepancy between implicit agonistic and transcendence motives rated by interviewers; $t(62)=3.03$, $p<0.01$, $d=0.77$. Thus, as predicted, ratings of agonistic goals and transcendence goals by interviewers and observers on the one hand, and by participants on the other, appear to yield different information.

Hypothesis 2: Everyday Self-Regulatory Capabilities *Moderate* the Relationship between Implicit Agonistic Motives and Ambulatory Blood Pressure

Past research suggested that emotion-regulation capabilities assessed with a laboratory attention-shifting task did not predict ambulatory blood pressure levels directly, but instead *magnified* the association between agonistic striving and blood pressure during daily activities [5]. Self-regulatory skills and deficits observed by teachers thus are expected to amplify the relationship between implicit agonistic motives and blood pressure. Bivariate correlations (Table 3) obtained in the present study are consistent with this prediction; implicit agonistic and transcendent goals rated by observers and interviewers are significantly correlated with ambulatory blood pressure, whereas teacher ratings of emotion-regulation are not. Correlations in Table 3 also indicate that *explicit* self-reported motives do *not* predict ambulatory pressure.

The combined effects of implicit agonistic motives and self-regulatory behaviors specified by Hypothesis 2 were tested by regressing blood pressure during daily social interactions on (a) observer-/self-rated agonistic goals; (b) teacher indices of self-regulation; and (c) the interactions of the latter variables with the former. This analysis used the

Table 2 Correlations among observer, interviewer, and participant self-report ratings of agonistic goals and transcendence goals

	Mean	(SD)	Agonistic goals			Transcendence goals		
			Observer	Interviewer	Self-report	Observer	Interviewer	Self-report
Agonistic goals								
Observer	14.87	(4.52)						
Interviewer	19.88	(8.56)	0.79**					
Self-Report	28.33	(11.47)	0.40**	0.36*				
Transcendence goals								
Observer	15.52	(5.89)	−0.63**	−0.51**	−0.19			
Interviewer	22.28	(13.10)	−0.56**	−0.34*	−0.21	0.84**		
Self-Report	36.76	(12.12)	0.01	0.04	0.59**	0.16	0.21	

*$p=0.05$, **$p<0.001$

Table 3 Agonistic Goals (AG) and Transcendence Goals (TG) Indexed by observer, interviewer, and self-report, and teacher-rated self-regulatory capabilities, correlated with ambulatory blood pressure during social interaction (Pearson *r*)[a]

	Ambulatory blood pressure (mmHg)		
Informant	SBP	DBP	MAP
Observer			
AG	0.33**	0.33**	0.35**
TG	−0.34**	−0.39**	−0.40**
Interviewer			
AG	0.14	0.29*	0.23
TG	−0.32*	−0.37**	−0.38**
Self-report			
AG	0.02	−0.03	0.02
TG	−0.06	−0.20	−0.16
Teacher			
Internalizing	0.16	0.10	0.14
Externalizing	0.07	−0.09	−0.02
Self-Control	0.19	−0.12	−0.16

SBP systolic blood pressure, *DBP* diastolic blood pressure; *MAP* mean arterial pressure

*p=0.05, **p<0.01

[a] Partial correlations controlling for body mass index (BMI) and gender

observer measure of agonistic motivation because observer ratings could not have been affected by the rater's having seen or interacted with the participants. The analytic models regressed the mean level of ambulatory blood pressure during social interaction on agonistic goals, one of the three self-regulation (moderator) variables (Internalizing, Externalizing, Self-Control), body mass, gender, and the interaction of agonistic motivation and the moderator variable. These analyses revealed significant effects of agonistic motivation for all of the blood pressure variables, and significant interaction effects of agonistic and self-regulation indices for systolic pressure. Results of the regression models predicting systolic pressure (Table 4) showed that implicit agonistic goals rated by the observers and two teacher indices of self-regulatory capabilities (Internalizing, Self-Control) interacted to predict higher ambulatory systolic pressure during daily social encounters. The independent main effect of implicit agonistic goals was significant in these regressions, but the main effect of teacher-rated self-regulation capabilities was not. The agonistic-by-Externalizing interaction term was not statistically significant (p<0.09).

The interaction of agonistic goals and self-regulation moderator variables (Internalizing, Self-Control) in predicting systolic pressure is shown in Figs. 1 and 2, which depict the simple slopes for the effect of agonistic motivation on systolic pressure at mean levels of the Internalizing (Model η^2=0.32, ω=0.26, R^2=0.32; interaction model change in R^2=0.06, F=5.30, p<0.05) and the Self-Control (Model η^2=0.32, ω=0.26, R^2=0.32; interaction model change in R^2=0.05, F=4.19, p<0.05) moderators, as well as for one standard deviation (SD) above and below the mean. In participants who exhibit mean and higher (+1 SD) levels of Internalizing behaviors (Fig. 1), agonistic motivation predicts increased systolic pressure (b=0.86, SE=0.31, p< 0.01; b=1.48, SE=0.41, p<0.001); whereas in those who exhibit below average (−1 SD) levels of Internalizing behavior, agonistic motivation does not significantly predict systolic pressure (b=0.25, SE=0.40, p=0.53). Similarly, in participants who exhibit mean and lower (−1 SD) levels of Self-Control (Fig. 2), agonistic motivation predicts increased systolic pressure (b=0.81, SE=0.30, p<0.01; b= 1.22, SE=0.35, p<0.001); whereas in those who exhibit higher than average (+1 SD) levels of Self-Control, agonistic motivation does not predict systolic outcomes (b=0.41, SE=0.37, p=0.28). Although the interaction between agonistic goals and Externalizing behavior did not surpass alpha=0.05, we also performed a simple slope analysis for the effect of agonistic motivation at different levels of Externalizing behaviors (Model: η^2=0.29, ω=0.23, R^2=0.29; interaction model change in R^2=0.03, F=2.99, p=0.08). The results for Externalizing behavior resemble the pattern seen with Internalizing behavior: at average and higher levels of Externalizing, agonistic goals have a stronger association with systolic pressure. The systolic data thus support the hypothesis that an impaired ability to regulate emotions and social behavior combines with agonistic motivation to increase prevailing blood pressure levels.

As noted above, none of the agonistic-by-self-regulation interactions were significant for diastolic pressure (range, b=−0.07 (SE=0.05), p=0.15 to b=0.05, p=0.46). In predicting mean arterial pressure, the interactions of agonistic goals with Internalizing behaviors and Self-Control approached but did not attain significance; b=0.13 (SE=0.07), p=0.06; b=−0.09 (SE=0.05), p=0.06. The interaction between agonistic goals and Externalizing behaviors predicting mean arterial pressure was not significant, b=0.09 (SE=0.07), p=0.20.

The same regression model was used to analyze the self-rating data. These analyses revealed that neither the participants' self-rated (explicit) agonistic motives nor the teacher ratings of self-regulation predicted any of the blood pressure variables (all values of p>0.15). However, the analyses did detect a statistically significant interaction: self-rated agonistic goals interacted with teacher-rated Self-Control to predict higher levels of systolic pressure (b=−0.07, (SE= 0.03), p<0.01). Analysis of the simple slopes for the systolic effect of explicit agonistic motivation at different levels of the Self-Control moderator showed that, in participants who exhibited the *lowest* (−1 SD) levels of Self-Control, explicit agonistic motives predicted increased systolic pressure (b= 0.55, SE=0.23, p=0.02), whereas in those who exhibited

Table 4 Regression of ambulatory systolic pressure during social interaction on agonistic goals (AG), self-regulation capability (internalizing, externalizing, self-control), and their interaction, controlling for Body Mass Index (BMI) and gender

Independent variable	*b*	SE	*t*	*p*	Effect Size	
					partial-η^2	partial-ω
AG × Internalizing						
BMI	0.78	0.24	3.30	0.001	0.16	0.13
Gender	4.15	2.76	1.51	0.14	0.04	0.02
Internalizing	−0.28	0.50	0.56	0.58	0.01	0.00
AG	0.86	0.31	2.80	0.01	0.12	0.10
AG × Internalizing	0.21	0.09	2.30	0.02	0.08	0.06
AG × Externalizing						
BMI	0.72	0.23	3.13	0.001	0.14	0.12
Gender	4.76	2.78	1.71	0.09	0.05	0.03
Externalizing	0.11	0.43	0.25	0.80	0.00	0.00
AG	0.85	0.31	2.78	0.01	0.12	0.10
AG × Externalizing	0.16	0.09	1.73	0.09	0.05	0.03
AG × Self-Control						
BMI	0.77	0.23	3.33	0.001	0.16	0.14
Gender	3.49	2.81	1.24	0.22	0.03	0.01
Self-Control	−0.32	0.32	−1.00	0.32	0.02	0.00
AG	0.81	0.30	2.68	0.01	0.11	0.09
AG × Self-Control	−0.14	0.07	−2.05	0.05	0.07	0.05

SE standard error, *b* unstandardized regression coefficient

average (Mean) and above average (+1 SD) levels of Self-Control, this effect was not significant, b=0.06 (SE=0.04), p=0.11 and b=0.06, (SE=0.04), p=0.13, respectively.

Explicit agonistic goals interacted with teacher-rated Self-Control to predict diastolic pressure (b=−0.09, SE=0.02, p<0.01). Analysis of simple slopes reveled that, in individuals with moderate (Mean) and low (−1 SD) levels of Self-Control, self-reported agonistic motives significantly predicted diastolic pressure, b=0.21, SE=0.09, p=0.03, and b=0.59, SE=0.15, p<0.01, respectively. The explicit agonistic-by-self-regulation interactions predicting diastolic pressure were not significant for Internalizing or Externalizing behavior, b=0.06 (SE=0.04), p=0.11 and b=0.06, (SE=0.04), p=0.13, respectively

Discussion

Biological models that postulate pathologies arising from exposure to chronic stress require theories to explain how

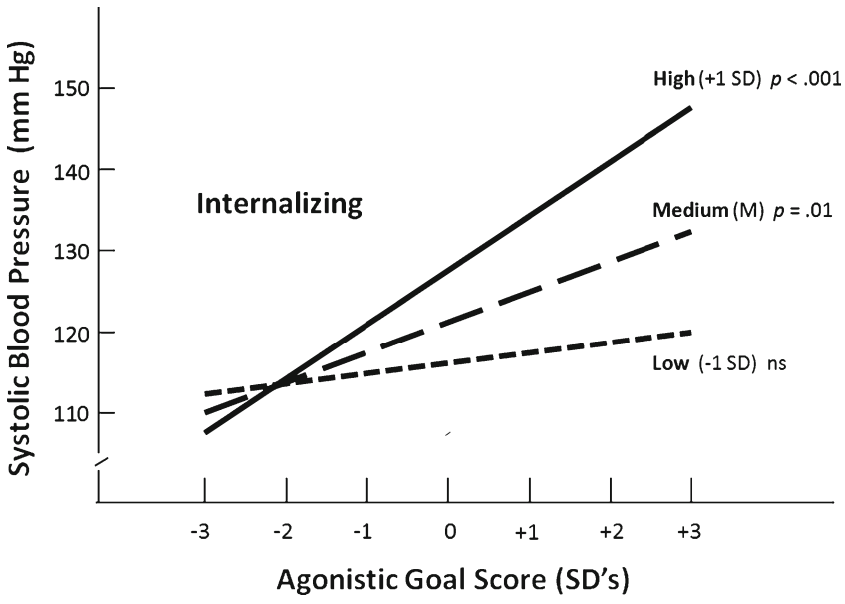

Fig. 1 Interaction of implicit agonistic motives with levels of teacher-rated internalizing behavior predicting systolic pressure level during daily social interactions. The agonistic motivation scale is shown in standard deviation units

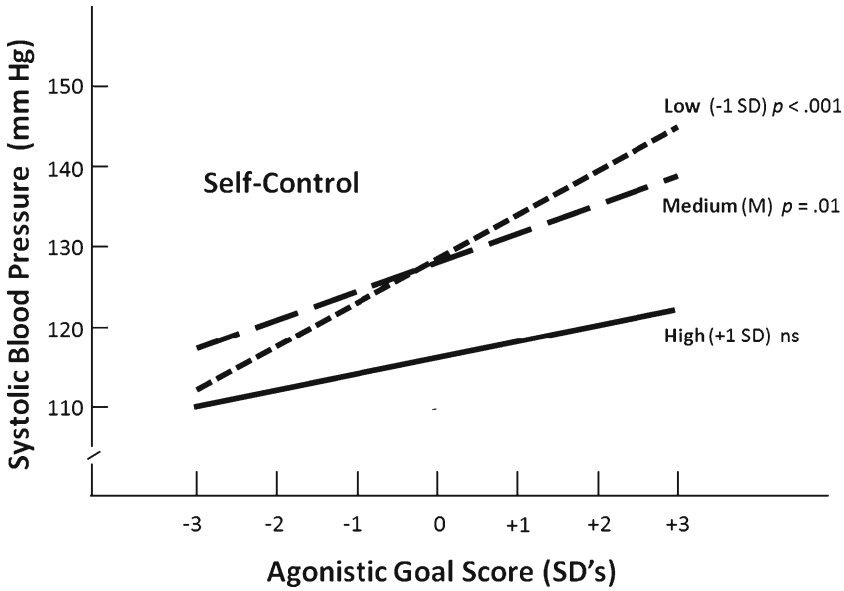

Fig. 2 Interaction of implicit agonistic motives with levels of teacher-rated self-control behavior predicting systolic pressure level during daily social interactions. The agonistic motivation scale is shown in standard deviation units

people become chronically exposed to stressful circumstances. A psychological approach to chronic exposure calls attention to the role of motives, a topic not specifically addressed in prevailing reactivity, trait, social-cognitive, or interpersonal-transactional stress research. Constructs such as Type A, hostility, and other disease-prone personality traits point to a connection between psychological phenomena and cardiovascular disease but offer little guidance about the nature of underlying causal mechanisms that foster recurring stress exposure and chronic arousal [15]. Causal understanding has been greatly advanced by research within a transactional framework, which shows how problematic interpersonal exchanges generate appraisals of social dominance and hostility that have adverse emotional and cardiovascular effects [2]. This work raises larger questions about the psychosocial factors that cause such exchanges to develop and to be sustained over time [1]. Research on child vulnerability and resilience has highlighted the importance of self-regulatory capabilities in shaping developmental outcomes. Investigators have focused on the role of attention-control mechanisms in modulating self-regulation and enhancing resilience and promoting positive social and emotional growth [30] but have less clearly articulated how the acquisition of self-control skills influences biological development and the physiology of stress-related illnesses.

Social action theory's social–motivational analysis seeks to systematize these highly diverse literatures [22]. The theory specifies how self-goals impel, guide, and organize interpersonal appraisals, expectancies, emotions, behaviors, and physiological responses to generate disease-prone traits and foster recurring social encounters that may undermine health. The concept of motivational focus—trying to change others versus trying to change the self—can explain why agonistic strivings generate chronic stress. A large research literature in animals and humans indicates that the magnitude of physiological reactions to diverse stressors is greatly affected by an organism's ability to anticipate or control threatening events [22]. Striving to influence or control another person's thoughts, feelings, or actions involves investing in a goal and outcome that the other person largely controls. Such agonistic investment can generate power struggles whose eventual course and consequences can be difficult to predict or manage. Struggling to change oneself (transcendence striving) can be highly threatening because failing to achieve a cherished self-goal or personal standard can foster self-recrimination and despair. Yet anticipating one's own actions is less uncertain than anticipating another person's, and it often is feasible to manage the anxiety of an achievement threat by altering one's goals, self-standards, and implementation plans.

In specifying goals that may increase stress exposure, a social–motivational analysis also identifies self-regulatory mechanisms that enable people to modulate the physiological effects of stressful experiences. The physiological impact of agonistic strivings may be moderated by skill in shaping interpersonal encounters and in regulating social emotions such as contempt, anger, and shame. The physiological impact of transcendence strivings may be moderated by skill in readjusting self-standards. In both cases, mechanisms of attention-shifting and cognitive appraisal play a crucial role. This theoretical approach offers a framework to integrate disparate findings from different research literatures that link stress resilience or vulnerability to disease-prone personality traits, stress-inducing interpersonal encounters, or the development of self-regulatory capabilities. Such integration suggests new ways to investigate psychosocial phenomena that separate literatures suggest are significant determinants of health or illness. Studies of

disease-prone traits have yielded suggestive but often conflicting results [15]. Developmental studies of social–emotional competence and resilience outcomes indicate that self-regulatory skills are important, yet a variety of relationships have been reported [23]: Social–emotional skills in some cases are linked to resilience directly, in other cases they interact with other variables (e.g., emotionality), or exhibit non-linear relationships. This state of affairs may reflect the presence of other unmeasured influences, such as implicit goals that cause the measured self-regulatory abilities to be more important in some life circumstances than in others. Social action theory thus offers a promising conceptual framework to systematically examine how implicit motives and self-regulatory abilities may operate together or separately, directly and indirectly, to increase stress vulnerability.

The present study offers new support for this model by shedding light on how implicit social control motives may interact with everyday self-regulation capabilities in natural settings to elevate blood pressure and increase cardiovascular risk. This study is the first to test the hypothesis that *implicit* indices of stress coping goals may predict daily ambulatory blood pressure levels more reliably than explicit indices do, and to offer evidence that agonistic motives interact with internalizing and self-control behaviors in real-world settings to shape cardiovascular risk.

Do Implicit and Explicit Measures of Motivation Yield Different Information?

Implicit goals assessed with the SCI film narrative technique yield information about cardiovascular risk that is not obtainable from explicit self-reports obtained by questionnaire immediately post-interview. Analyses of motives rated by interviewers, observers, and participants indicated high levels of agreement between interviewers and observers but modest to poor agreement with participants' self-reports. Although the participants' reports of their agonistic motives correlated modestly with ratings of agonistic motives made by interviewers and observers, the participants' ratings of their transcendence motives showed virtually no correlation with interviewer or observer ratings of transcendence motivation. It also is noteworthy that, whereas ratings of agonistic goals were negatively correlated with ratings of transcendence goals in the interviewer and observer data, participants' self-ratings of agonistic goals and transcendence goals were positively correlated. Further analyses suggested that participants also differed from external raters in displaying a notable *transcendence bias*, that is, they rated their transcendence motives more highly than their agonistic motives. These findings support the hypothesis that indices of implicit and explicit motives yield very different kinds of information about the self-goals that guide a person's actions in stressful situations: Implicit indices measure action goals that usually are not a focus of direct attention and self-monitoring [16, 17], whereas explicit indices measure goals that are generated through deliberate acts of reflective self-appraisal and communication. As such, self-reports of coping goals assessed with questionnaires may reflect deliberate decisions and consciously self-articulated reasons for acting. Although self-attributions and appraisals may be related to overtly expressed health attitudes and deliberate behavioral choices, they may not reveal the implicit goals that often shape stress exposure and responding in everyday settings. Self-report assessment techniques thus could underestimate the importance of motivational mechanisms in stress and illness.

Do Control Motives and Everyday Self-Regulation Skills Interact to Elevate Risk?

The present findings also extend results of laboratory research into real-world contexts by showing that one's ability to regulate emotions in familiar everyday settings moderates the cardiovascular impact of agonistic striving. Regression analyses testing the independent and interactive contributions of implicit agonistic motives and naturalistic self-regulation to blood pressure levels found a significant main effect for agonistic motivation on all indices of ambulatory pressure, combined with significant agonistic-by-self-regulation (Internalizing, Self-Control) interaction effects for systolic pressure. These findings suggest that implicit agonistic motives increase blood pressure and—as predicted—the association between implicit agonistic motives and higher blood pressure in daily social encounters is magnified further in persons who exhibit self-regulatory deficits reflected in higher levels of Internalizing behavior or lower levels of Self-Control behavior observed in classroom settings. The association of implicit agonistic motivation with higher systolic pressure appears to be amplified by difficulties in regulating anxiety and sadness, possibly reflecting increased inhibition (e.g., "over-control"), or by difficulties in regulating social behavior in the classroom, perhaps reflecting a lack of behavioral control (e.g., "under-control;" 24). These possibilities merit further investigation. The failure of Externalizing to magnify the association of agonistic goals with blood pressure may be due to the fact that characteristic indicators of Externalizing, such as temper tantrums and overt physical aggression, are less likely to be observed frequently in the setting of a high school classroom.

Participants' self-reported agonistic motives did not predict blood pressure levels directly, but interacted with low Self-Control to predict higher blood pressure. Thus, although participants' ratings may have been less indicative of their degree of cardiovascular risk, the significant

interaction effect supported the pattern seen in the analyses of the observer ratings.

The finding that self-regulation capabilities observed by teachers moderated the relationship between agonistic goals and blood pressure suggests that the moderation effect observed earlier with a controlled attention-shifting task also is detected with indices of real-world self-regulation in a school classroom. The blood pressure outcomes predicted by the two indices of self-regulation (attention-shifting vs teacher ratings) differed, however, in that implicit agonistic motivation interacted with the laboratory attention-control task to predict diastolic pressure, and with the teacher ratings to predict systolic pressure.

One possible explanation for the diverging blood pressure results might involve the well-established finding that different behavioral challenges tend to evoke different patterns of systolic and diastolic responding. Systolic blood pressure levels are highly sensitive to myocardial changes that are associated with active behavioral coping, for example, whereas diastolic levels are highly sensitive to changes in vascular resistance that are associated with heightened vigilance to potential threats [31]. Laboratory tasks that participants appraise as difficult but manageable (e.g., "challenging") have been shown to evoke a pattern of cardiovascular changes characterized by increased cardiac output, reflected in elevated systolic blood pressure, whereas laboratory tasks that are appraised as difficult and unmanageable (e.g., "threatening") have been shown to evoke a pattern of cardiovascular changes characterized by increased peripheral resistance, reflected in elevated diastolic pressure [32]. It is possible that the classroom self-regulatory behaviors readily noticed by teachers involve enhanced myocardial responding associated with challenging activities (e.g., asking and answering questions), whereas the attention-control task used to assess self-regulatory skills in the larger Project Heart 5 study evoked enhanced peripheral resistance associated with response to a perceived threat. The latter task, by first focusing attention on an angry memory, may have elicited a predominantly vascular response pattern that indexes a tendency to exhibit heightened diastolic pressure [31]. Despite this difference, however, more noteworthy here is the finding that the relationships between agonistic motivation, self-regulation indices, and ambulatory blood pressure levels exhibited the predicted pattern of direct and interactive effects.

Limitations and Future Directions

Limitations of the present research are concomitants of its strengths. Sampling a highly diverse population of youth within the same social environment of a high school strengthens the ability to discern how stress processes operate during an important developmental period. Yet this approach does not show if the relationships between agonistic striving and self-regulation reported here occur at other points in the human life span. A second limitation is the fact that everyday self-regulation behavior was assessed only in a school setting, by teachers' observations; participants were not observed in other settings, nor did other observers apart from the teacher conduct observations of self-regulatory behaviors in school. It also would be desirable to obtain assessments of adolescent self-regulation from parents and peers.

Despite these limitations, the present findings suggest fruitful directions for future investigation. First, implicit motives emerge as underappreciated players in the field of stress research, where stress vulnerability and coping are typically assessed as broad personality traits (e.g., hostility, optimism, hopelessness) measured with questionnaires. The finding that correlations between control motives (agonistic, transcendence) and self-regulation capabilities (Internalizing, Externalizing, Self-Control) were weak or not significant suggests that the agonistic and transcendence goal constructs are not redundant with more familiar constructs such as "emotionality" or emotion-regulation. This result is consistent with the findings reported previously that agonistic and transcendence motives were unrelated to the frequency or intensity of negative emotions recorded on electronic diaries at 30-min intervals over 2 days [5, 24].

Second, these results suggest new directions for preventive clinical interventions. Findings from two large Project Heart studies indicate that agonistic and transcendence profiles occur with similar frequencies across differences of gender, race, and geographic region. Recent data from Project Heart 5 indicate, further, that agonistic striving mediates much of the association between exposure to a stressful neighborhood environment and elevated blood pressure in both Black and White youth [24]. Present findings suggest that indices of everyday self-regulation that teachers can readily report might be used to identify youths in whom recurring agonistic struggles may be especially detrimental to health. Implicit motives assessed with the SCI predict large differences in cardiovascular risk that are unrelated to resting blood pressure levels or to self-reports of stressful emotions or stress-related goals. Everyday emotion-regulation behaviors observed by teachers in natural settings may not predict risk directly, but they do augment prediction when combined with SCI indices of implicit agonistic goals. This suggests that behavior ratings by teachers, and assessment of implicit agonistic motives with the 10-min SCI, could be used together with other risk indices (e.g., high normal blood pressure, family history of heart disease, exposure to stressful neighborhood environment) to better identify highly vulnerable adolescent subgroups who may benefit from preventive school-based behavioral interventions to lower blood pressure [33, 34]. Based on emerging

findings reported here and elsewhere, it now seems appropriate to investigate methods to alter agonistic motives, and evaluate how changing motivational focus alters prevailing blood pressure levels.

Conflict of Interest Statement The authors have no conflict of interest to disclose.

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